

CLAIMS

1. System for guiding a catheter through a lumen system of a body of a patient, to a predetermined location within the lumen system, the system comprising:

5 a medical positioning system including at least one position detector, said at least one position detector being firmly attached to a distal portion of said catheter, said medical positioning system determining the position of said at least one position detector;

 a moving mechanism coupled with said catheter; and

10 a controller coupled with said medical positioning system and with said moving mechanism, for controlling the operation of said moving mechanism to move said catheter to said predetermined location, according to said position and according to a topological representation of at least a portion of said lumen system.

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2. The system according to claim 1, further comprising:

 an imaging system for detecting an image of said at least one portion; and

 a superimposition processor coupled with said medical
20 positioning system and with said imaging system, said superimposition processor superimposing a representation of said distal portion on said image, to be displayed on a display coupled with said superimposition processor.

3. The system according to claim 1, wherein said superimposition processor superimposes said topological representation on said image, to be displayed on said display.
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4. The system according to claim 2, wherein said display displays a curve respective of the shape of said distal portion, according to said coordinate signal.
- 10 5. The system according to claim 2, wherein said imaging system is selected from the list consisting of:
- X-ray table;
 - fluoroscope;
 - C-arm imager;
 - 15 computed tomography;
 - magnetic resonance imager;
 - positron emission tomography; and
 - ultrasound system.
- 20 6. The system according to claim 1, further comprising an organ monitor coupled with a monitored organ of said body and with said medical positioning system, said monitored organ being coupled with said lumen system, said organ monitor monitoring an organ timing signal

of said monitored organ and of said lumen system, wherein said controller updates said topological representation and said position, according to said organ timing signal; and

wherein said controller controls the operation of said moving mechanism according to at least one of an updated topological representation and an updated position of said distal portion.

7. The system according to claim 6, further comprising a processor coupled with said medical positioning system, said processor updating said topological representation and a representation of said distal portion according to said organ timing signal, said processor producing a reconstructed image of said at least one portion according to said organ timing signal, said processor superposing at least one of an updated topological representation and an updated representation of said distal portion on said reconstructed image, to be displayed on a display coupled with said processor.

8. The system according to claim 6, wherein said organ monitor is selected from the list consisting of:
- electrocardiogram; and
- filtered MPS reading.

9. The system according to claim 1, wherein said moving mechanism is disposable.
10. The system according to claim 1, wherein said moving mechanism
5 comprises:
at least one moving element;
a plurality of angular movement rollers coupled with said at least one moving element, said angular movement rollers twisting said catheter by a selected amount about a longitudinal axis of said
10 catheter; and
a plurality of linear movement rollers coupled with said at least one moving element, said linear movement rollers moving said catheter along said longitudinal axis.
11. The system according to claim 1, further comprising a joystick
15 coupled with said moving element for manually operating said moving mechanism.
12. The system according to claim 1, wherein the coupling between said
20 medical positioning system and said at least one position detector is selected from the list consisting of:
conductive; and
wireless.

13. The system according to claim 1, wherein said topological representation is a preplanned path between an origin and said predetermined location.

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14. The system according to claim 1, wherein said catheter is in form of a guidewire.

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15. The system according to claim 1, wherein at least a portion of said catheter is made of an Electro Active Polymer.

16. Method for guiding a catheter to a predetermined location within a lumen system of a body of a patient, the method comprising the procedures of:

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determining a new position to move said catheter to, according to a position signal received respective of a first position of a distal portion of said catheter, and according to a topological representation of said lumen system;

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operating a moving mechanism to move said catheter to a second position, according to said new determined position;

receiving said position signal and performing said operating procedure, when said second position is substantially identical with said new determined position, and determining at least one corrective

movement, when said second position is not identical with said new determined position; and

directing said moving mechanism to move said catheter according to said determined corrective movement.

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17. The method according to claim 16, further comprising a preliminary procedure of receiving said position signal.

18. The method according to claim 16, further comprising the procedures of:

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updating at least one of said topological representation, said first position and said second position, according to an organ timing signal of an organ timing monitor coupled with a monitored organ of said body, said monitored organ being coupled with said lumen system; and

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controlling said moving mechanism according to at least one of said updated topological representation, said updated first position and said updated second position.

20 19. The method according to claim 18, wherein said organ timing signal is selected from the list consisting of:

electrocardiogram; and

filtered MPS reading.

20. The method according to claim 18, further comprising a preliminary procedure of receiving said organ timing signal.
- 5 21. The method according to claim 20, further comprising a preliminary procedure of detecting said organ timing signal.
22. The method according to claim 18, further comprising the procedures of:
- 10 superposing a representation of at least one of said updated first position and said updated second position on an image of at least a portion of said lumen system; and
- displaying said superposition.
- 15 23. The method according to claim 22, further comprising the procedures of:
- superposing said updated topological representation on said image; and
- displaying said superposition of said updated topological
- 20 representation on said image.
24. The method according to claim 22, wherein said image is reconstructed according to said organ timing signal.

25. The method according to claim 22, wherein said image is produced by an imaging system in real time.
- 5 26. The method according to claim 22, wherein said displaying procedure includes a sub-procedure of transforming a three-dimensional coordinate system of a medical positioning system for determining at least one of said first position and said second position, to a two-dimensional coordinate system of said image.
- 10 27. The method according to claim 16, further comprising a preliminary procedure of constructing said topological representation, by indicating an origin and a destination on an image of at least a portion of said lumen, in a coordinate system respective of said body.
- 15 28. The method according to claim 27, wherein said image is produced by imaging said at least one portion, at at least one unparallel imaging planes.
- 20 29. The method according to claim 16, further comprising a procedure of imaging at least a portion of said lumen system at at least one image plane which is closest to said predetermined path, among a plurality of other image planes.

30. The method according to claim 16, further comprising a procedure of imaging at least a portion of said lumen system at at least one other image plane, when in at least one prior image plane, at least a portion of at least one lumen system overlaps said lumen system.
31. The method according to claim 16, further comprising a procedure of determining the shape of said distal portion, according to a plurality of position signals received respective of positions of a plurality of position detectors located at said distal portion, after performing said procedure of operating.
32. The method according to claim 16, wherein said at least one corrective movement is selected from the list consisting of:
- along a longitudinal axis of said catheter relative to at least a portion of said lumen; and
 - about said longitudinal axis relative to said at least one portion.
33. The method according to claim 16, wherein said at least one corrective movement is determined, when the orientation of said distal portion at a certain location within said lumen system, is different than at least one slope of said three-dimensional path at said certain location.